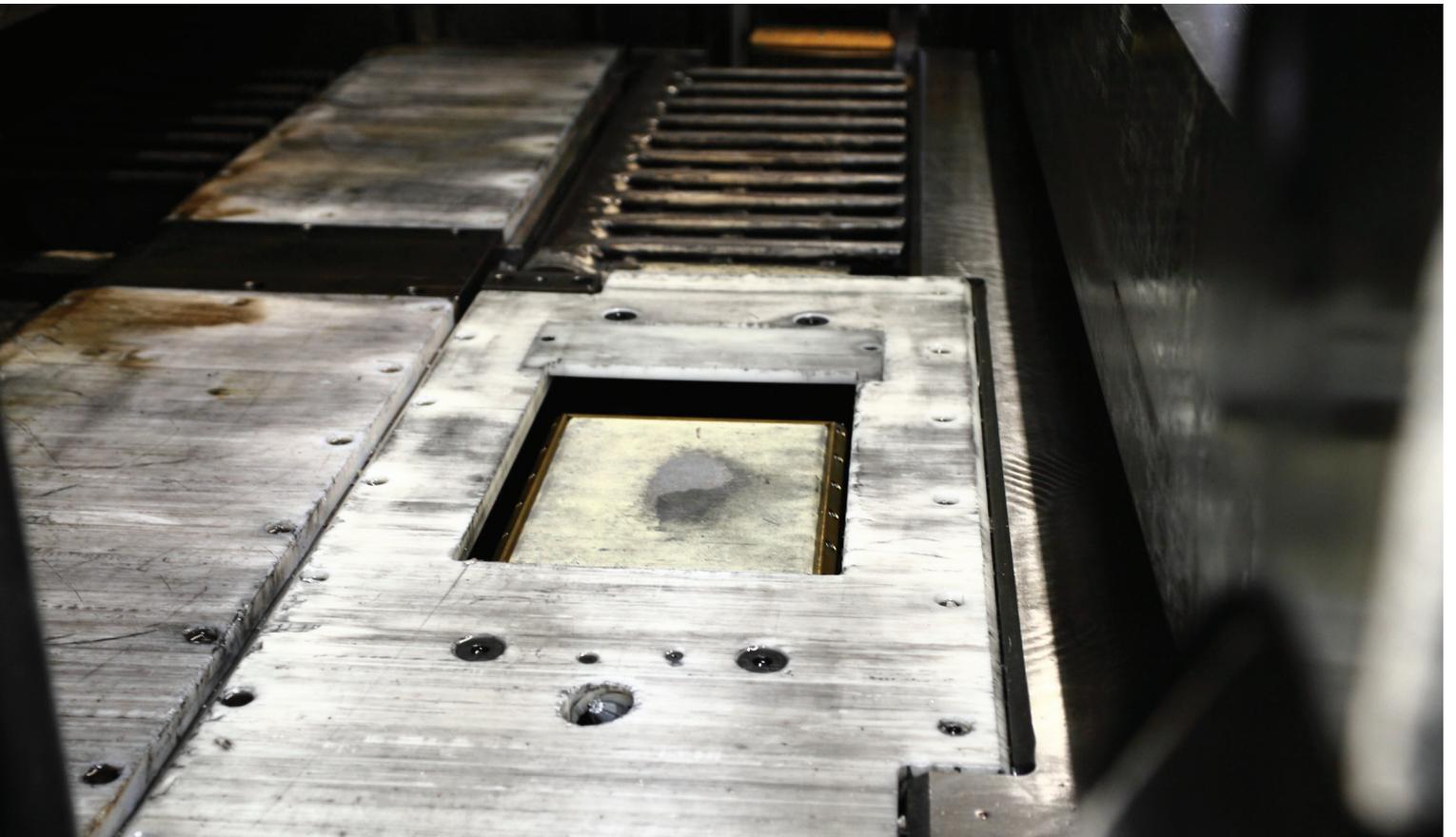


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MEASUREMENT & ANALYTICS

# Millmate thickness gauging systems

MTG Box Gauge – Gapless gauging  
for aluminium strip



# Millmate thickness gauging systems

## Imagine outstanding dependability

Gauge control is crucial for modern rolling mills. Strip producers around the world have replaced their X-ray and contact gauges with ABB's Millmate Thickness Gauge (MTG) and have improved their competitiveness.

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01 The aluminium rolling mill operations at Profilglass S.p.a in Fano, Italy, has more than fifteen years of experience using Millmate Thickness Gauges.

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02 Twin-roll caster

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03 Cold rolling mill application at Novelis, Switzerland.

### Application

The MTG Box Gauge is designed for use in aluminium cold rolling mills and aluminium continuous casters. In rolling mills, the MTG systems are connected to AGC systems for feedback, feedforward and massflow control.

### PEC Technology

The MTG Box Gauge, based on PEC (Pulsed Eddy Current) technology, opens up new dimensions in aluminium strip gauging. Weak magnetic fields are used for measurement and the gauge is completely safe to use.

The technology is completely insensitive to anything in the measuring zone, except the metal strip. The gauge will, therefore, measure true strip thickness, unaffected by coolant, dirt, steam, air temperature variations, etc.

Since the MTG Box Gauge is material-independent, there is no need for alloy compensation and calibration.

### Increased mill production time

In a production process running 24 hours a day, every minute of production time is precious. Thanks to its alloy independence, the MTG can increase available production time by eliminating the need to stop for standardization and calibration.

The hydraulic positioning system allows the gauge to measure almost instantaneously when tension comes on, thus optimizing the strip length under thickness control.

### Tighter strip tolerances

The ability to produce strip to tighter tolerance maximizes productivity and minimizes the costs associated with non-conforming strip. It also increases the strip producer's accessible market to include products with tighter tolerance requirements.

Alloy chemistry variations that are within tolerance but affect the accuracy of X-ray gauges will not influence the alloy independent MTG Box Gauge. Neither will the harshest environmental conditions. Together with the compact design, this makes it the ideal gauge for interstand applications, thus opening up new possibilities for controlling thickness deviation.

### No health concerns

Switching to the MTG Box Gauge from X-ray or isotope gauges eliminates health and environmental concerns as well as the inconvenience of restricted areas. This makes your plant a safer and more efficient place to work. It also means no costs for training and certification of your employees and no costs for disposing of radioactive waste material.

### Negligible costs for maintenance

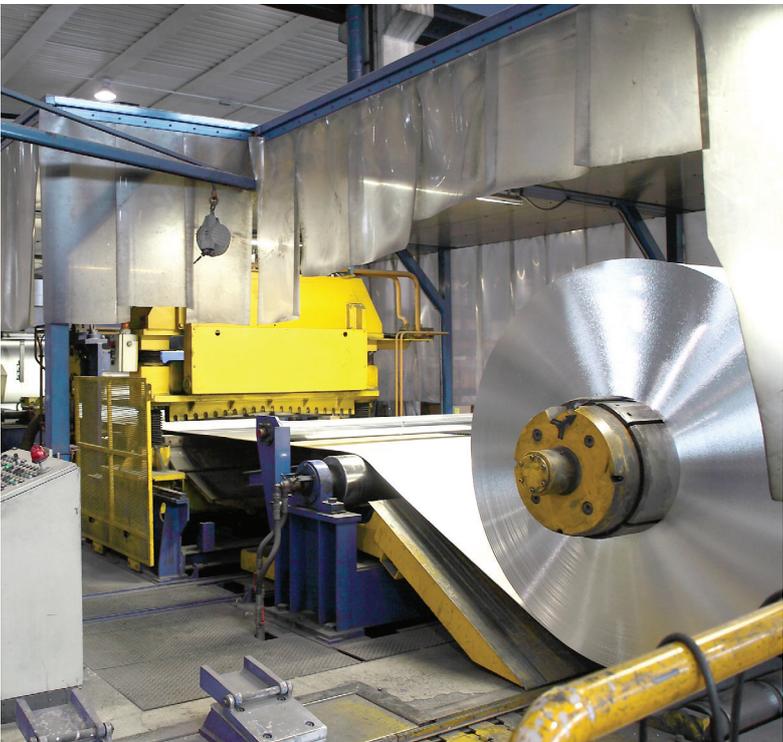
Share the experience of a virtually maintenance-free gauge with a large number of MTG users. Our robust gauge design, with no fragile or aging components, makes this possible. The MTG Box Gauge has no X-ray source or detector, no high voltage transformer, and no delicate precision mechanics.

### Short payback time (ROI)

Each process application has potential for improvement. Add up your costs for mill downtime, non-conforming material, maintenance, spare parts, calibration and security associated with your existing X-ray, isotope or contact gauges. We can help you compare this to the cost of ownership of an MTG Box Gauge and we're sure you will find that the MTG Box Gauge offers you a short and competitive ROI.



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# MTG Box Gauge

## Opportunities you didn't know existed

Due to its heavy duty construction and the stability of its measuring principle, the MTG Box Gauge can be used in locations where it is impossible for other gauges to function.

— 01 The MTG Box Gauge head with holder for vertical positioning.

— 02 MTG Box Gauge head with calibration plates mounted on top.

— 03 Traceable calibration plates supplied by ABB.

— 04 MTG Box Gauge installation in rolling mill.

### Gapless gauging

The gauge consists of just one box as sensing element – the MTG Box Gauge head. This unique invention introduces gapless gauging, with nothing above the pass line that can obstruct the strip passage. The gauge head can be installed below the mill table for best protection during threading, tail out and strip breaks.

### New control opportunities

The MTG Box Gauge measures accurately independent of environment. This means that it can be located closer to the rollgap than conventional gauges, or even interstand, without concern for mill coolant. Consequently, as the sensor can be placed at the very heart of the process, new levels for control of thickness errors and faster feed back can be reached.

### Opening for process improvements

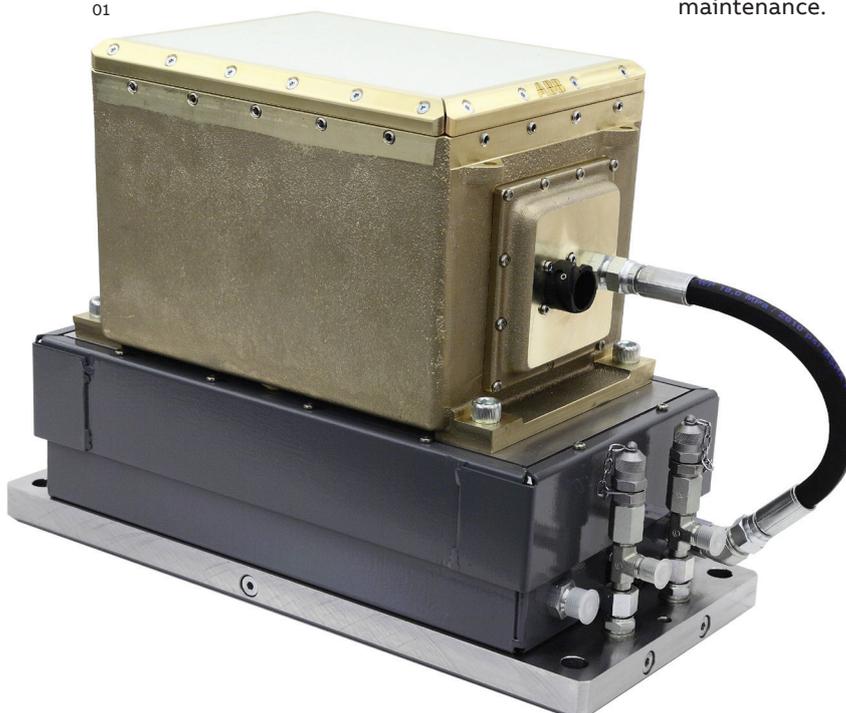
The Millmate Thickness Gauge offers substantial savings for non-ferrous strip production.

### Main benefits

- No material dependence
  - Any aluminium alloy can be measured without using alloy compensation factors.
- No environmental influence
  - Neither mill coolants nor air temperature changes have any effect on the measurement.
- No need for security measures
  - The MTG Box Gauge uses a safe and environmentally friendly technology.
- Low signal drift
  - Only two system calibrations recommended annually – each done in less than 20 minutes.
- Fast commissioning
  - Delivered calibrated and ready to use.

These benefits contribute to a higher material yield, higher production time, and a minimal need for maintenance.

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### Function

The MTG Box Gauge is based on PEC technology, which uses magnetic fields for measurement of strip thickness. The interaction between an applied magnetic field and the electrically conductive strip indicates thickness – without influence from the material composition.

The pulsed magnetic field is generated and measured by sturdy electric coils placed just below the cover plate. Since the magnetic field penetrates everything except metal, the coils can be protected by a heavy-duty fiberglass reinforced epoxy plate.

### Traceable thickness measurement

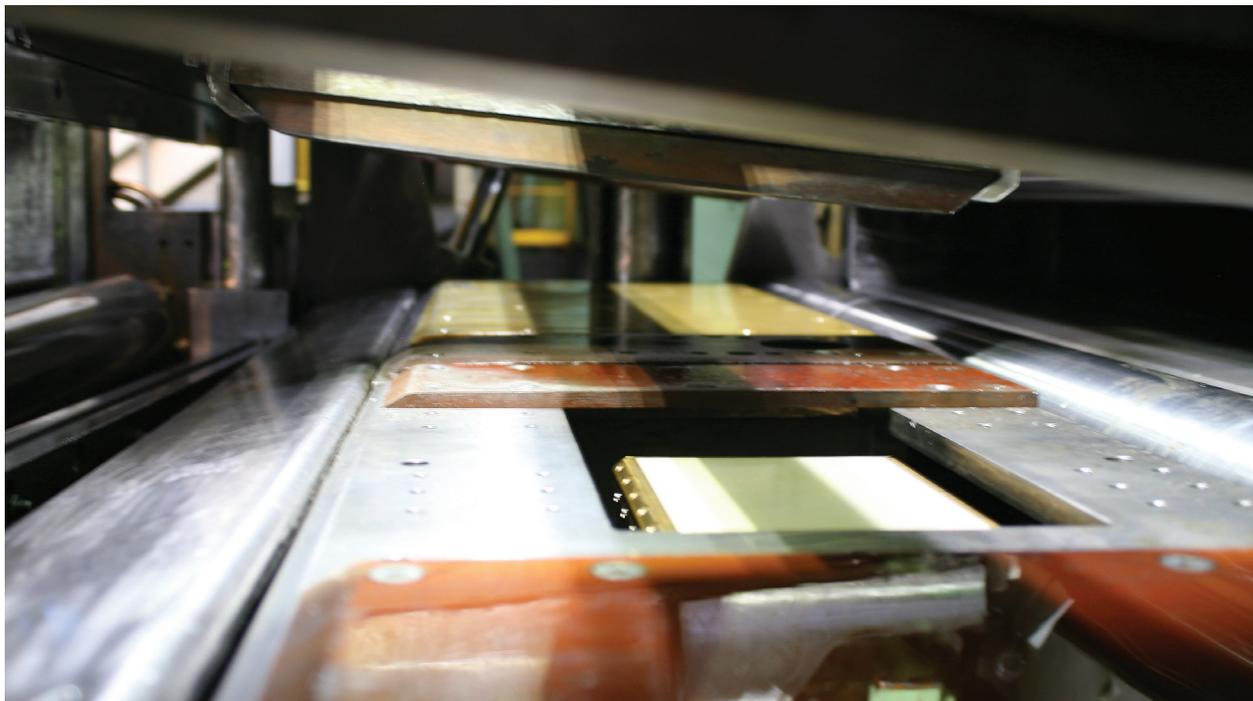
The MTG Box Gauge is delivered thoroughly calibrated from the factory. Twelve calibration plates are supplied with the system for verification and adjustment of the complete measuring range.

These calibration plates ensure that the gauge measures absolute thickness and thickness deviation according to traceable standards for many years of operation. A normal calibration interval is 6 months and only takes 20 minutes to perform.

### Robust design

The aluminium-bronze housing has superior mechanical and chemical characteristics and provides robust protection for the gauge, making it optimal for harsh rolling mill environments.

The gauge is mounted on a vertically moving frame, automatically adjusting its position to maintain an optimal measuring distance. The movement is operated with hydraulic valves.

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# System concept

## A user-friendly design

ABB offers a gauging system with outstanding dependability, opening up new opportunities to improve your competitiveness.

### Control unit

The control unit is used for integration with other mill systems. It provides a choice of integration interfaces.

- Profibus-DP fieldbus communication
- Network communication via VIP, OPC DA and Modbus TCP.
- Discrete I/O-signals

The Control unit also handles communication with the gauge. It communicates measurement data, system status, system control, error handling as well as implementing vertical position control functions.

### Operator unit

The application software is installed in an industrial computer. It can be combined either with a touch-screen for panel installation or with a standard office monitor.

The computer and monitor can be separated by using a KVM Extender which enables a safe environment for the computer even though the monitor is placed close to the process.

The HMI has a number of features including unit handling, different user access levels, and selectable languages.

### Air regulator

The air regulator filters the air and controls air pressure in the gauge. The air is used for internal temperature control and provides over-pressure to prevent coolant, etc., from entering the gauge.

### System functions

All system functions can be performed through the Operator unit.

The main functions are divided into four groups – Operation, Diagnostics, Service and Settings.

### Operation

In the Operation category, the operator can read and adjust current set-ups, thickness value and status information. Thickness deviation is presented as a real-time value as well as in a trend graph.

### Diagnostics

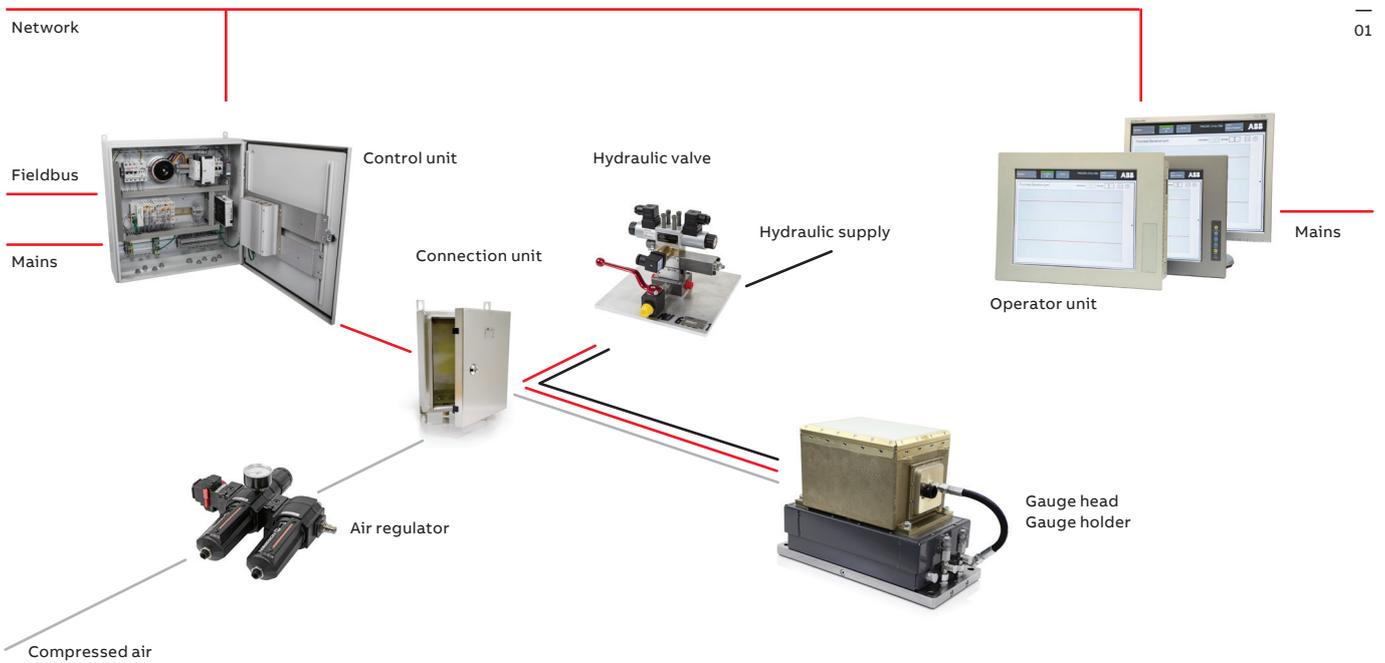
The diagnostics category includes functions that allow the user to see current system status, information about errors and warnings, and other vital system properties.

### Service

The service category contains use case based actions that are service related. Calibration as well as manual control functions, are in this section.

### Settings

In the settings category the system can be adapted to local conditions. Examples of system settings are HMI theme, full screen, language, IP addresses, etc.



01 The Millmate thickness gauging system is an intelligent measurement system designed for user-friendly commissioning, operation and service.

## System interface

### Solutions for system integration

The MTG system can easily be connected to AGC systems, based on feedback, feedforward and massflow control.

The Millmate Thickness Gauge can easily be integrated with a mill control system or other higher level systems. The MTG system offers different solutions for system integration both with discrete I/O signals and communication via a network. The Operator's unit, with colour graphic touch-screen, is a user-friendly interface for manual operation and maintenance.

Thickness deviation is available as a fast analogue output. Status signals and gauge position control can also be handled via I/O-signals.

### Network communication

As a complement to I/O signals different Ethernet communication protocols are available. The Vendor Internet Protocol (VIP) uses predefined data telegrams to exchange information on measurement data, system status and system set-up.

The sending procedure is cyclic and the receiving procedure reacts on incoming messages.

Modbus TCP is also available for Ethernet communication. The protocol is used in the same manner as VIP.

The OPC protocol is yet another means to connect the MTG Box Gauge to higher level systems via Ethernet. The system supports OPC DA Data Access as an option. To gain access to measurement data and system set-up, a higher level computer with OPC-client functionality can communicate with the Control unit.

### Profibus-DP

As an option, the MTG system can be equipped with a Profibus-DP slave interface for communication with the rolling mill control system. The Profibus-DP interface provides fast transfer of measurement data. It can also be used for setting up nominal thickness and for remote control of system settings and gauge movement.

# Data

## MTG Box Gauge PMG200

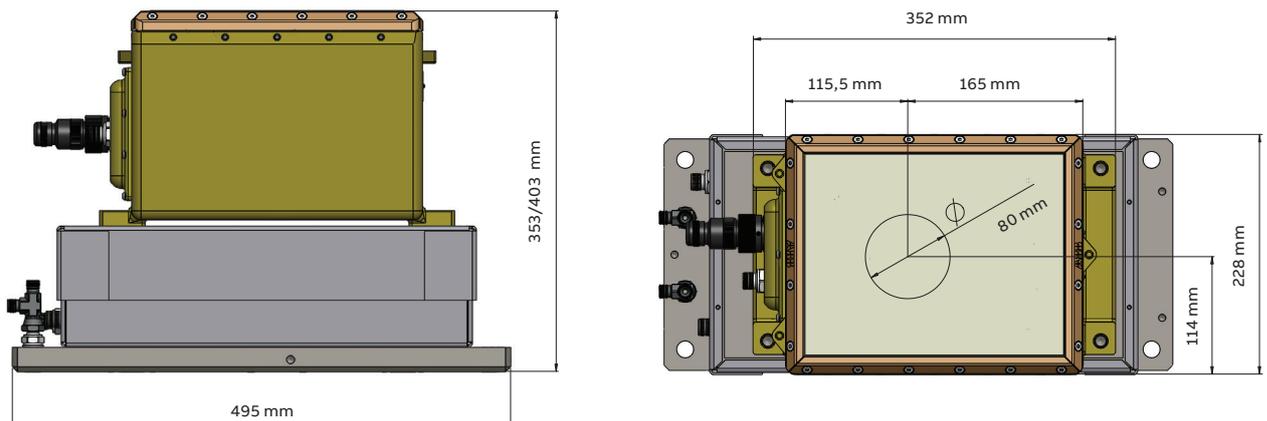
### PMGG201-H Gauge head

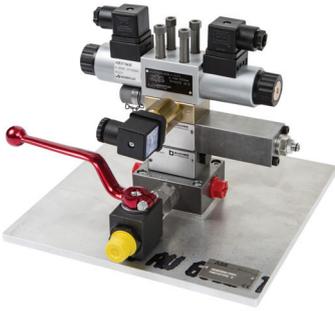
|   |   |
|---|---|
| Thickness measurement                         | 0.5 to 8 mm (20 to 315 mil)   |
| High pass mode (for Feed Forward)             | 0.2 to 0.6 mm (8 to 24 mil)   |
| Measured alloys                               | Aluminium, clad aluminium and other nonferrous alloys with resistivity range 27 to 65 nΩm |
| Repeatability                                 | ±0.05% (not better than 0.3 μm (12 μin))  |
| Accuracy <sup>1</sup>                         | ±0.05% (not better than 0.5 μm (20 μin))  |
| Total accuracy <sup>2</sup>                   | ±(0.05% +1.5 μm (59 μin))   |
| Total accuracy, clad measurement <sup>3</sup> | ±(0.05% +2 μm (79 μin))   |
| Oil on strip                                  | No influence  |
| Measuring distance                            | 15 mm (590 mil)   |
| Minimum strip width                           | 500 mm (20 in)  |
| Min distance from strip edge                  | 100 mm (4 in)   |
| Measuring area                                | Ø 80 mm (3.15 in)   |
| Strip position changes > 1 mm/s / >39 mil/s   | ±5 mm (± 197 mil)   |
| Strip slope                                   | ±6°   |
| Gauge holder stroke length                    | 50 mm (2.0 in)  |
| Updating time                                 | 5 ms  |
| Operation temperature                         | +5 to +70°C (+41 to +158°F)   |
| Degree of protection                          | IP 65   |
| Power supply (from control unit)              | 24 V DC, max 3 A (48 V AC, max 5A)  |
| <b>Weight</b>                                 |   |
| Gauge head                                    | 22 kg (48.5 lb)   |
| Gauge holder                                  | 48 kg (105.8 lb)  |
| <b>Size</b>                                   |   |
| Gauge head                                    | L 352 x W 228 x H 209 mm (L 13.9 x W 9.0 x H 8.2 in)                                      |
| Gauge head and holder                         | L 495 x W 228 x H 353/403 mm (L 19.5 x W 9.0 x H 13.9/15.9 in)                            |

<sup>1</sup> Accuracy = Accuracy after calibration, measured on a calibration plate.

<sup>2</sup> Total Accuracy = Accuracy after calibration, measured on an arbitrarily selected plate/strip at normal mill operating conditions, i.e. with mill coolants, temperature variations, pass line variations and alloy composition variations.

<sup>3</sup> Provided that input clad parameters are correct.



**Hydraulics**

|                  |  |
|------------------|--|
| Working pressure | 50 bar (725 psi)   |
| Input pressure   | 80 to 160 bar (1160 to 2320 psi)                         |
| Flow             | 5 l/min (176 ozpm)                                       |
| Pressure switch  | 40 bar (580 psi)   |
| Pressure fluid   | Mineral oils DIN 51524 (HL,HLP), Phosphate ester (HFD-R) |

**Air regulator**

|                         |   |
|-------------------------|---|
| Supply pressure         | 5 to 16 bar (72,5 to 232 psi)   |
| Air consumption         | 5 dm <sup>3</sup> /s (11 cfm)   |
| Air quality requirement | Acc to PNEUROP  |
| Particle class 3        | Particle size max 1 µm (40 µin), particle content max 5 mg/m <sup>3</sup> |
| Oil content class 3     | Max1 mg/m <sup>3</sup>  |
| Condensation class 3    | Condensation at +10° C (50 °F)  |

**Control unit PMGA201**

|                         |   |
|-------------------------|---|
| Operation temperature   | +5 to 45° C (41 to 113 °F)                        |
| Supply voltage          | 115/230 V +10/-15 %                               |
| Power consumption       | 300 VA  |
| <b>Wall cabinet</b>     |   |
| Protection              | IP 64   |
| Dimensions              | H 658xW 600xD 200 mm (H 25,9xW 23,6xD 7,9 inch)   |
| <b>Floor cabinet</b>    |   |
| Protection              | IP 54 or IP 21                                    |
| Dimensions              | H 2225xW 700xD 600 mm (H 87,6xW 27,6xD 23,6 inch) |
| <b>System interface</b> |   |
| I/O                     | 2AO, 2AI, 8DO, 8DI                                |
| Network communication   | VIP,OPC DA, Modbus TCP                            |
| Fieldbus                | ProfibusDP  |

**Operator unit****Industrial computer**

|                  |   |
|------------------|---|
| Supply voltage   | 24 VDC, 120 W via AC power adapter 100 to 240 V |
| Protection class | IP 40   |

**Monitors**

|            |                            |
|------------|----------------------------|
| 17"        | Panel mounted touch-screen |
| 22" or 24" | Flat screen                |

# Aluminium clad material Option

— 01 The MTG Clad function is used to measure accurate thickness of clad aluminium with up to four liners, two on each side of the core.

The MTG system measures the thickness of clad material with less error, due to variations in alloy composition and clad geometry, than an x-ray gauge.

The MTG is well-known for providing material-independent thickness measurement on homogeneous, non-ferrous strip, without the need for any alloy information. With the optional clad measurement function, the MTG measures the thickness of multi-layer aluminium clad strip with superior accuracy.

The built-in clad function only requires information about each clad layer's nominal thickness and resistivity. The resistivity can be determined with support functions included in the scope of supply.

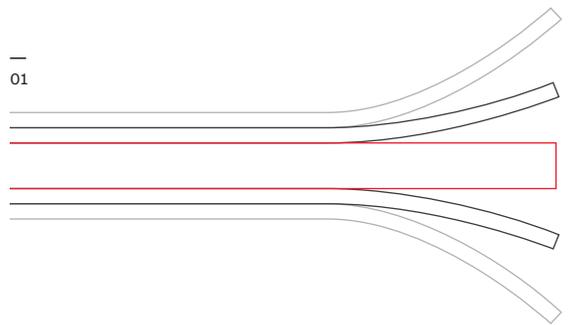
The start-up and commissioning routines for the clad function are straightforward and easy to use. The need for test plates is limited. New types of clad material can easily be added, without the need for time-consuming tests and calibration procedures.

### Scope of supply

- Software for clad material measurement.
- PC-software for calculation of the resistivity based on the alloy compensation – Clad Help Function.

| Data                          |                               |
|-------------------------------|-------------------------------|
| Total accuracy clad function* | $\pm(0.05\% + 2 \mu\text{m})$ |

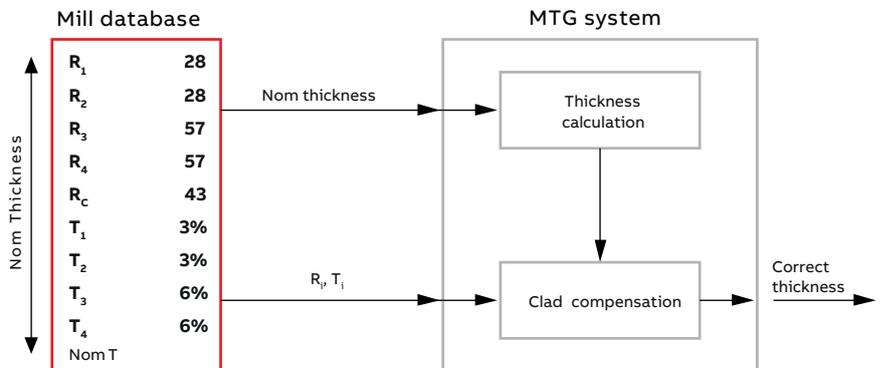
\* Provided that information about clad layer parameters is correct.



### Function overview

#### Clad parameters

|                             |                               |
|-----------------------------|-------------------------------|
| Liner 1 Thickness ( $T_1$ ) | Liner 1 Resistivity ( $R_1$ ) |
| Liner 3 Thickness ( $T_3$ ) | Liner 3 Resistivity ( $R_3$ ) |
| Core Resistivity ( $R_c$ )  |                               |
| Liner 4 Thickness ( $T_4$ ) | Liner 4 Resistivity ( $R_4$ ) |
| Liner 2 Thickness ( $T_2$ ) | Liner 2 Resistivity ( $R_2$ ) |



# High pass mode

## Option

- 01 High pass mode, thin range
- Optional function for feed forward applications.
  - Measures high frequency thickness variations.
  - Intended for entry side or interstand gauge position.
  - Does not read slow thickness variations or average thickness.

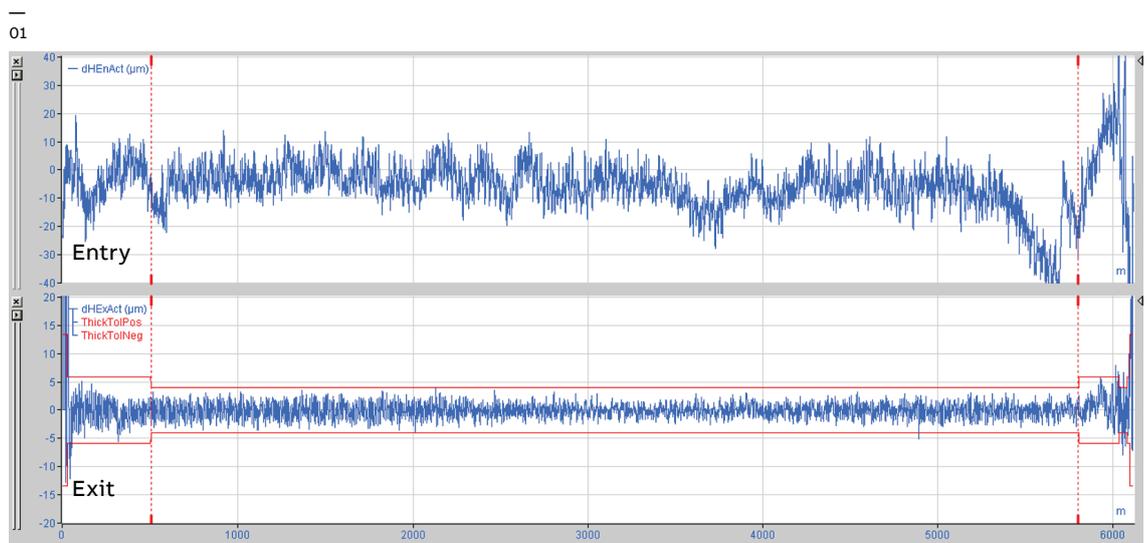
High pass mode is an optional function in the MTG Box Gauge system which enables the measurement of high frequency thickness variations in the lower thickness range.

The function reads thickness changes that are faster than 0.024 Hz with low noise, whereas persistent changes lasting longer than about 10 seconds will be zeroed. The intended application is for feed forward control in rolling mills (entry side or interstand) with the purpose of reducing thickness variations.

The output value is scaled according to the input nominal thickness value. Provided that the nominal thickness value is reasonably close to the actual average thickness, the thickness variation signal indicates the real strip thickness variations with high accuracy.

The function is not meaningful in feedback applications (exit side) as any change in average thickness will be filtered out. This means also that reference measurement and calibration cannot be performed in high pass mode.

| Data              |               |
|-------------------|---------------|
| Thickness range   | 0.6 to 0.2 mm |
| Cut off frequency | 0.024 Hz      |





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